Claims

1. A measurement apparatus for vehicle body alignment work, which measurement apparatus can be placed in connection with an alignment table (10) to whose fastenings ($11a_1$,$11a_2$,$11a_3$,$11a_4$) the vehicle is attached for the time of the alignment work, and a measurement unit ($17a_1$,$17a_2$) of which measurement apparatus (15) can be moved in a vertical guide ($15b_1$,$15b_2$), which vertical guide ($15b_1$,$15b_2$) can further be moved in a longitudinal guide ($15a_1$,$15a_2$), and which measurement unit ($17a_1$) can be provided with a movable measurement arm (40), **characterized** in that the measurement arm (40) comprises an articulation (41) to which a first arm part (42) is connected such that the arm part (42) can be pivoted on support of the articulation (41) with respect to the measurement arm (40), and that to the arm part (42) is connected a second arm part (43) which can be turned around its longitudinal axis (X_{30}), to which second arm part (43) a measurement head (65) is connected either directly or through an intermediate part.

2. A measurement apparatus for vehicle body alignment work as claimed in claim 1, **characterized** in that a second structure formed by the arm parts (42,43) can be extended in the direction of the longitudinal axis (X_{20}) of the arm part (42) such that the second arm part (43) can be displaced with respect to the first arm part (42) to different length positions.

3. A measurement apparatus as claimed in any one of the preceding claims, **characterized** in that the second arm part (43) comprises at its end a through hole (64) through which the measurement head (65) is passed perpendicularly to the longitudinal axis (X_{30}) of the second arm part.

4. A measurement apparatus as claimed in any one of the preceding claims, **characterized** in that the articulation (41) at the end of the measurement arm (40) comprises a sleeve part (44), a backing body (48) being pivotable with respect to the sleeve part (44) to alternative angular positions such that the backing body (48) comprises at its end face (48b) holes ($49a_1$,$49a_2$...), and that the sleeve (44) placed

against it comprises at its end face (44b) holes ($45a_1$,$45a_2$,$45a_3$), into which balls ($46a_1$,$46a_2$...) are positioned in locking positions, and that the balls ($46a_1$,$46a_2$) and springs ($47a_1$,$47a_2$) pressing the balls are placed into the holes ($49a_1$,$49a_2$...) of the backing body (48), the backing body (48) being pivotable to a desired angular position/locking position according to the spacing determined by the angular distance between the holes, and that the arm part (42) associated with the backing body (48) can be turned in a horizontal plane with respect to the measurement arm (40).

5. A measurement apparatus as claimed in any one of the preceding claims, **characterized** in that the first arm part (42) comprises at its both ends holes ($55a_1'$, $55a_1$; $55a_2'$,$55a_2$... $56a_1'$,$56a_1$;$56a_2'$,$56a_2$ ...), in which connection springs ($61a_1$, $61a_2$...) and balls ($62a_1$,$62a_2$) situated in holes ($60a_1'$,$60a_1$;$60a_2'$,$60a_2$) of the second arm part (43) can be brought alternatively either into the holes ($55a_1'$,$55a_1$...) of one end of the arm part (42) or into the holes ($56a_1'$,$56a_1$...) of the other end thereof, in which connection the balls ($62a_1$,$62a_2$...) can be turned through a desired angular spacing and they will be positioned alternatively in the holes ($55a_1'$,$55a_1$... or $56a_1'$,$56a_1$...) of the first arm part (42) in locking positions.

6. A measurement apparatus as claimed in any one of the preceding claims, **characterized** in that the second arm part (43) comprises an end piece (700) and therein a through hole (64) for the measurement head (65), and that the measurement head (65) comprises grooves ($66a_1$,$66a_2$), in which connection the measurement head (65) can be placed in alternative positions, the end piece (700) comprising an end stub (67) into whose inner hole (68) a ball (69) and a spring (70) are placed, a screw (71) pressing the ball (69) into one of the grooves ($66a_1$ or $66a_2$...) defined by the locking position of the measurement head (65).

7. A measurement apparatus as claimed in any one of the preceding claims, **characterized** in that the second arm part (43) comprises an end sleeve (600) at the end on the side of the first arm part (42), which end sleeve is attached by means of a cotter (63) to a metal portion (430) of the second arm part (43), and that the holes ($60a_1$,

$60a_1'$,$60a_2$,$60a_2'$) have been made into the end sleeve (600) made of plastic, thereby enabling good bearing properties for the balls ($62a_1$,$62a_1'$...).

8. A measurement apparatus as claimed in any one of the preceding claims, **characterized** in that the first arm part (42) comprises end threads (57) at its end, onto which threads a nut (59) can be mounted, so that by means of a tension sleeve (58) situated between the nut (59) and the arm part (43) the arm part (43) can be locked to different positions with respect to the first arm part (42), the tension sleeve (58) being split in a longitudinal direction, thereby serving as a tension washer when the nut (50) tightens it against the arm part (43), the thread (57) being a taper thread.

9. A method in vehicle body alignment work in measurement of a vehicle body, which method employs a measurement apparatus (15) which is connected to an alignment table and which comprises guides ($15a_1$,$15a_2$) extending parallel to the longitudinal axis (X) of the vehicle as well as vertical guides ($15b_1$,$15b_2$), the vertical guides ($15b_1$,$15b_2$) moving in the longitudinal guides ($15a_1$,$15a_2$) and comprising a measurement unit ($17a_1$,$17a_2$) which can be moved in the vertical guides ($15b_1$,$15b_2$), and that the measurement unit ($17a_1$,$17a_2$) is provided with a movable measurement arm (40) which can be moved in a horizontal direction with respect to the measurement unit ($17a_1$), **characterized** in that the measurement apparatus used is such that it comprises at the end of the measurement arm (40) a movable first arm part (42) which moves in a horizontal plane, and that a second arm part (43) is connected to said arm part (42) which can be moved and positioned in a horizontal plane, said second arm part (43) being rotatable around its longitudinal axis (X_{30}), and that a measurement head (64) is connected to the second arm part (43), whereby, by using the arrangement in accordance with the invention, the measurement locations situated inside the vehicle body (A) can also be measured by the same measurement head (64).

10. A method as claimed in claim 9, **characterized** in that, in the method, the combination of locking positions of each arm part (42,43) and the measurement head (64) connected to the measurement arm (40) is read and fed into the memory of a

computer or said combination is detected electrically by using position detectors which indicate the pivot position of the arm part (42), the rotation position of the second arm part (43) connected to the first arm part (42) and the linear position of the measurement head (64) connected to the second arm part (43), and that, based on said data fed or directly electrically detected, the result of measurement is directly indicated on the display of the computer or equivalent and/or said measurement result is printed as a measurement record.

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